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A. RÜTTENAUER

INCLOSED ARC LAMP

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Fig.1.

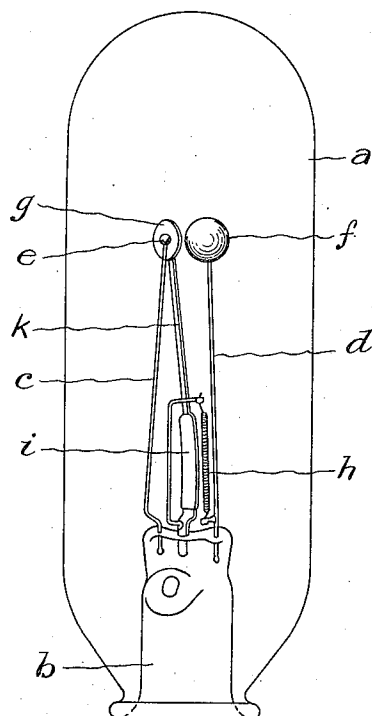


Fig.2.



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UNITED STATES PATENT OFFICE.

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INCLOSED ARC LAMP.

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My invention relates to inclosed arc lamps, and in particular to arc lamps enclosed in a sealed envelope in which the electrodes used are metallic electrodes such as tungsten, iron, nickel, cobalt, or some of these metals mixed with an oxide.

The invention therefore relates to inclosed arc lamps having a movable auxiliary oxide electrode and aims, by a special arrangement and connection of the auxiliary electrode, not merely at a very reliable starting process, but particularly at facilitating a good transference of the arc to the two main electrodes of the lamp, one of which electrodes is large and the other of which is small. To this end the auxiliary oxide electrode which touches only one of the two main electrodes when the lamp is not burning, is connected, according to the invention, together with that main electrode which it does not touch, to a current supply lead. Since, with this arrangement and connection, when the lamp is connected to a source of current, the auxiliary electrode has a polarity different from that of the main electrode which it touches, the result is attained that the auxiliary electrode detaches itself from the small main electrode and an arc forms between the two electrodes. Further, the arc jumps from the auxiliary over to the large main electrode as soon as the auxiliary electrode is moved away sufficiently from the small main electrode. At the conclusion of the withdrawal of the auxiliary electrode the arc will then burn between the two main electrodes.

The new inclosed arc lamp can be operated on either direct current or alternating current circuits and can be used, not only for illumination, but also for the production of oscillations. The lamp can be used with particular advantage as a rectifier, provided the main electrode, which is touched by the auxiliary electrode, is very small and the other main electrode, which is not touched, is many times greater because, in this case, only the small main electrode will be brought to a white glow when the lamp is connected to A. C. circuits. Accordingly, the small main electrode will continue to act as a cathode. To increase the effect it is possible, in accordance with the invention, to make the cathode, which remains continuously in the state of white glow, of a mixture of a refractory metal and a refractory oxide, which mixture permits a more extensive electron emission. For instance, a mixture of tungsten and thorium oxide may be used. At the same time, the larger electrode, which serves as the anode, can be made of ordinary commercial metals, such as iron, nickel and cobalt.

The means for accomplishing the ends above indicated are hereinafter more fully set forth and claimed, reference being had to the accompanying drawing, in which Fig. 1 shows a lamp constructed in accordance with the principles of my invention. This figure shows the lamp in elevation, the usual lamp base having been omitted. Fig. 2 shows the electrodes in top view. The path of motion of the movable electrode being indicated by dotted lines.

Referring more in detail to the drawing, it will be seen that the arc lamp consists, in the conventional form of a glass container, *a*, similar to the bulb of an incandescent lamp, in whose base, *b*, there are fused the supports, *c* and *d*, of the two electrodes, *e* and *f*. Against the small main electrode, *e*, there lies a disk-shaped auxiliary electrode, *g*, which to the end of facilitating the starting, contains oxide in the conventional manner, and which consists for instance, of a mixture of 50 percent tungsten, and 50 percent thorium oxide. This auxiliary electrode, *g*, is connected to the supply lead, or to the support, *d*, of the considerably greater electrode, *f*, which it does not touch, said connection being effected by insertion of a glow wire, *h*, which when the current is applied, heats the bimetal strip, *i*, mounted in the support, *k*, of the auxiliary electrode, and makes it deflect so that the disk-shaped auxiliary electrode, *g*, will be removed from the electrode, *e*, with the formation of an arc. The bimetal strip, *i*, is arranged in such a manner that the auxiliary electrode, *g*, will be moved obliquely away from the electrode, *e*, when the current is applied and, in particular, so that the created arc will be made to approach, more and more, the larger electrode, *f*. As soon as the auxiliary electrode, *g*, is moved so far away from the electrode, *e*, that the distance between the two main electrodes, *e* and *f*, is shorter than that between the electrode, *e*, and the auxiliary electrode, *g*, as indicated by the dotted

lines in Fig. 2 the arc will jump from the auxiliary electrode, *g*, over to the second main electrode, *f*, which has already been heated due to its nearness to the arc. However, since the latter electrode is considerably greater than electrode, *e*, it will only attain a faint red glow, while electrode, *e*, will be in a state of white glow and by virtue of the electron emission will continuously act as a cathode. As a consequence of the process of ionization at the cathode, only current impulses in one direction will be permitted to pass, in the same manner as in a mercury arc rectifier, so that a current consuming apparatus or an energy accumulator, (battery, etc.) connected in series with the one or the other main electrode will be fed direct current instead of alternating current.

In order to increase the effect when the lamp is used as a rectifier, the smaller electrode is appropriately made of a mixture of a refractory metal and a refractory oxide, for instance, a mixture of tungsten and thorium oxide. Since such an electrode, compared with a pure tungsten electrode, gives a considerably greater electron emission, the small electrode, when it is of such a composition, need not be heated to such a high temperature as a pure tungsten electrode. The result will be that the life of the lamp will be considerably longer while the output of light will be smaller, but this latter factor will be no objection whatever where the lamp is used as a rectifier.

In the case of the small cathode consisting of tungsten containing oxide, which likewise is an advantage, the arc will not creep over to the support as easily as in the case of small pure tungsten electrodes, because the electrode body now effects a considerably greater electron emission compared to the support, even when the latter likewise becomes heated to a glow near to the electrode body, and this results in the arcs remaining on the small electrode body. The mixture to be used in the making of the small cathode depends upon the range of application of the rectifier. In some cases as much as 50 percent, or more thorium oxide can be admixed to the tungsten. As a rule, however, it is more advantageous to use considerably less thorium oxide in the glowing cathode than in the auxiliary electrode, appropriately about 5 to 30%, in order not to reduce the temperature of the electrode sphere too much.

To the end of reducing the cost of making, the larger main electrode, *f*, can be made of any cheap commercial metals causing a sufficiently high cathode drop and having a melting point above 1000°, as for instance, iron, nickel, or cobalt. If the lamp is to be used for illumination or production of oscillations, the two electrodes will appropriately be of the same dimensions and will

be made of pure tungsten. The fastening and the shape of the electrodes can also be modified at will.

Although I have described and illustrated my invention in connection with the specific form of device shown in the drawing, it will be understood that the invention is not so limited inasmuch as in view of the disclosure, the same principle may apply to other modifications without departing from the spirit of the invention or from the scope of the claims herein.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An arc device comprising a sealed container, a first electrode and a second electrode, said electrodes being stationary and located in proximity to each other, and a third electrode, the latter being movably mounted, and normally in contact with the first stationary electrode, means whereby a source of current may be connected with said device in such a manner that when the third electrode is moved an arc is started between the first and third electrodes and thereafter the second electrode is substituted for the third electrode and the arc established between the first and second electrodes, and a thermostatic element for so moving the third electrode, said electrodes being located within said container.

2. In an arc device, a pair of electrodes, said electrodes being stationary, separated and located within a sealed envelope, means for establishing an arc between said electrodes, one of said electrodes being comparatively small and the other comparatively large whereby the device may operate as a rectifier for alternating currents, said small electrode being made of a refractory metal and an oxide.

3. In an arc device, a pair of electrodes, said electrodes being stationary, separated and located within a sealed envelope, means for establishing an arc between said electrodes, one of said electrodes being comparatively small and the other comparatively large whereby the device may operate as a rectifier for alternating currents, said small electrode being made of tungsten and an oxide.

4. In an arc device, a pair of electrodes, said electrodes being stationary, separated and located within a sealed envelope, means for establishing an arc between said electrodes, one of said electrodes being comparatively small and the other comparatively large whereby the device may operate as a rectifier for alternating currents, said small electrode being made of a metal and an oxide, the oxide portion constituting over 25% of the metal.

5. In an arc device, a pair of electrodes, said electrodes being stationary, separated and located within a sealed envelope, means

for establishing an arc between said electrodes, one of said electrodes being comparatively small and the other comparatively large whereby the device may operate as a rectifier for alternating currents, said small electrode being made of a refractory metal and an oxide and the large electrode being made of a metal other than tungsten.

6. In an arc device, a pair of electrodes within a sealed envelope, means for establishing an arc between said electrodes, one of said electrodes being comparatively small and having a refractory metal and an oxide and the other electrode being comparatively large and having a metal other than tungsten.

7. The method of establishing an arc between a large electrode and a small electrode within a sealed envelope which consists in first drawing the arc between the small electrode and a third electrode until the small electrode becomes heated and thereafter withdrawing the third electrode from between the first two electrodes to cause the arc to be transferred and established directly between the small and the large electrodes.

8. An arc device comprising a sealed container, a first electrode and a second electrode, said electrodes being stationary and located in proximity of each other, and a third electrode, all of said electrodes being

located within said container, the third electrode being movably mounted and under the control of a thermostatic element, a pair of terminals for said device, one of said terminals being connected with the first electrode and the other terminal being connected with the second electrode, said third electrode being normally in contact with the first electrode and being connected with the second electrode through said thermostatic element whereby when a source of potential is applied across said terminals the thermostatic element is heated and the third electrode is separated from the first electrode and the arc started between the first and third electrodes, said movement being continued until the arc is forced to leave the third electrode and pass to the second electrode whereby an arc is established directly between the first and second electrodes.

9. In an arc device, a sealed container, a pair of electrodes separated and located within the sealed envelope, a third electrode normally located between the first two electrodes and a thermostatic element for starting the arc between one of the first electrodes and the third electrode and for withdrawing the third electrode from between the first two electrodes and leaving the arc established between the first two electrodes.

In witness whereof, I have hereunto set my hand this 15th day of April, 1925.

ALFRED RÜTTENAUER.